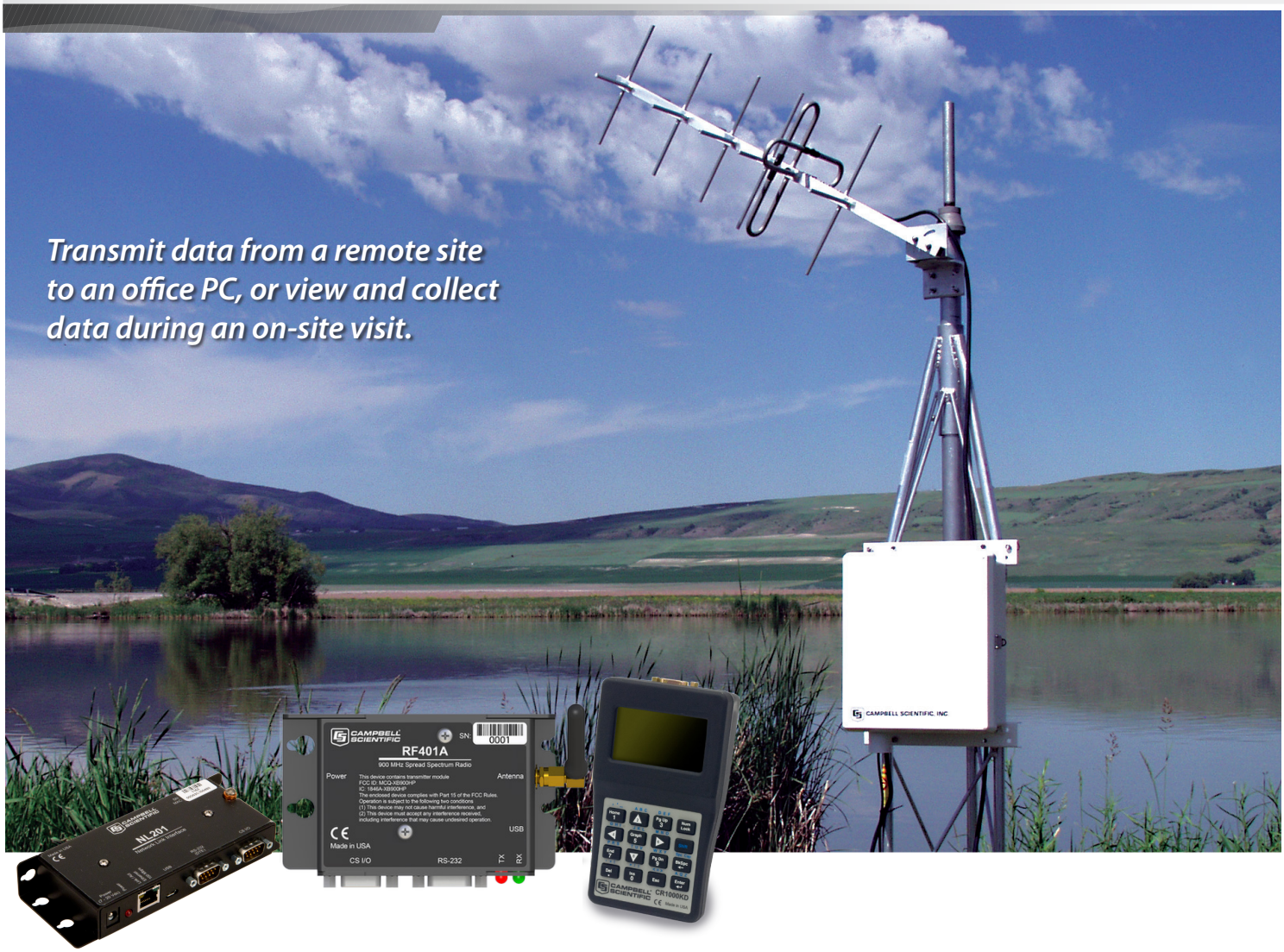
CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

Data Storage and Retrieval Peripherals

Wireless, remote, hard-wired, direct, or two-way communication



Campbell Scientific Communication Peripherals

Campbell Scientific offers a full line of data storage and retrieval peripherals. Whether you want to collect data during a site visit, contact your datalogger via telemetry, or both, our data storage and retrieval peripherals have wide operating temperature ranges allowing their use in extreme, remote environments.

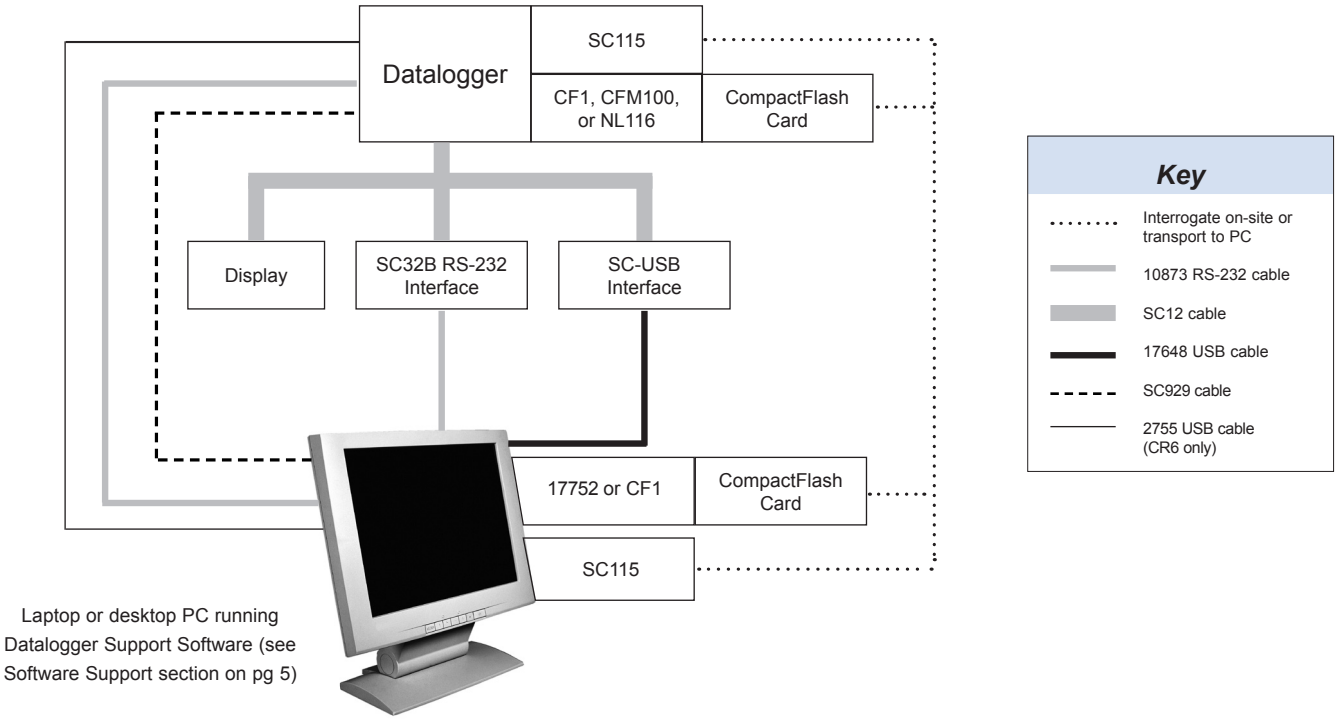
This station for the National Estuarine Research Reserve (NERR) in Virginia transmits data via our GOES satellite transmitter.

To determine the best data storage and retrieval method for your application, you should consider:

- **Accessibility of Site**—a dependable telemetry device that transmits data to a base station's computer is preferable for a site that is difficult to access. On the other hand, if your site is essentially in your backyard, you may want to collect data with a portable handheld device or laptop.
- **Availability of Service**—prior to the purchase of any equipment, you should determine if the appropriate coverage for cellular phones, RF systems, or satellite systems is available for your site. The use of telephones or the Internet requires that phone lines or an Internet connection be available within a few miles of the site.
- **Quantity of Data Collected**—this affects the transmission duration. For some telemetry devices, a long transmission length will significantly impact the current drain, and perhaps service costs.
- **Frequency of Data Collection**—if you need near real-time data, a telemetry device is indicated. If you only need to collect data every few weeks, you may prefer an on-site device.

To help you determine the best data storage and retrieval method for your application, this document describes our on-site and telemetry peripherals. For a quick comparison of devices, we recommend you review the telemetry comparison table on page 6 and the compatibility charts on pages 7 and 8.

On-Site Peripherals



External Data Storage Devices

These products are used to backup data, increase the datalogger's storage capability, or retrieve data from the datalogger's memory during a site visit.

Campbell Scientific offers 256 MB, 2 GB, and 16 GB CF cards that can be used with the CFM100 (above) or NL116.

- **SC115 Memory Drive**—stores 2 GB of data. One end connects with the datalogger's CS I/O port for retrieving data, and the other end connects with a PC's USB port for downloading data.
- **CFM100 and NL116 modules**—store data on one CompactFlash® (CF) card; the NL116 also supports Ethernet communications. Both the CFM100 and NL116 attach to the peripheral port on a CR1000 or CR3000 datalogger.
- **One MicroSD card**—read by the card slot that is integrated into the CR6 datalogger
- **One Type I, II, or III PC-card**—read by the PCMCIA card slot that is integrated into the CR9000X datalogger.
- **17752 Reader/Writer**—allows data stored on a CF or MicroSD card to be read by the USB port on a PC.
- **CF1 CompactFlash Adapter**—inserts into the PCMCIA card slot on a CR9000X datalogger or PC allowing the datalogger or PC to receive CF cards.

Direct Connect to Laptop or PC

The datalogger's USB and/or RS-232 port allows the datalogger to be directly connected to the PC (no interface required). On the CR200X-series, CR3000, and CR9000X, the RS-232 port is electrically isolated. Isolation is not provided by the RS-232 port on the CR800-series, CR6-series, and CR1000 dataloggers.

Alternatively, the datalogger can be connected to a PC using the datalogger's CS I/O port. When connecting to the datalogger's CS I/O port, a device that converts the CMOS logic levels of the datalogger to the RS-232 logic levels used by the PC is required. The following devices accomplish this:

SC32B CS I/O Interface

- **SC32B interface**—connects with the PC's 9-pin serial port via an SC12 CS I/O cable and an RS-232 cable. The interface also provides optical isolation.
- **SC-USB interface**—connects with the PC's USB port using an SC12 CS I/O and a USB cable. The interface also provides optical isolation.
- **SC115 interface**—connects with the PC's USB port either directly or via the supplied cables. The interface is not electrically isolated.
- **SC929 cable**—attaches directly to the 9-pin serial port on a battery-powered laptop. It does not provide electrical isolation, and draws approximately 100 mA from the datalogger.

Field Displays

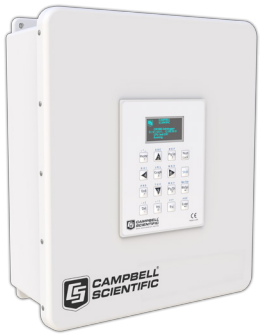
In most applications, data and communications interactions with the datalogger are displayed and monitored on a base station computer running one of our datalogger support software packages. The displays listed here are aimed at field use.

Datalogger Keyboard Displays

The datalogger's keyboard display provides on-site review of data values and program instructions. The keyboard display consists of a 128 by 64 pixels backlit LCD graphical or eight-line numeric display and 16-character keyboard.

- **Integrated keyboard display**—provided on the CR850 and CR3000 dataloggers.
- **CR1000KD portable keyboard display**—is used with our CR6, CR1000 and CR800. It may be carried from station to station in a datalogger network.

Mountable Displays



The CR1000KD and CD100 (left) support custom menus that allow customers to set up choices within the datalogger program.

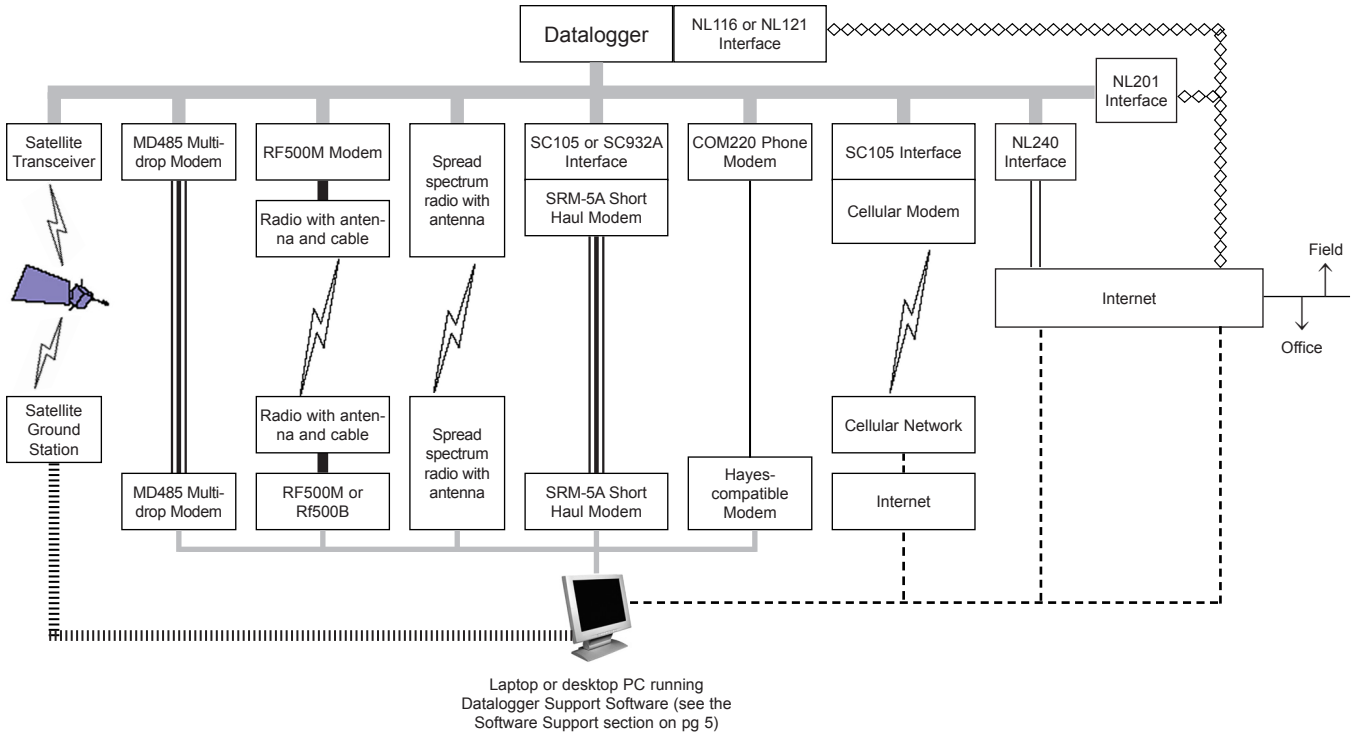
Campbell Scientific CD100 can be mounted in an enclosure lid allowing data entry and display without opening the enclosure. It provides the same functionality and operation as the CD1000KD. The CD100 has a 16-character keypad and can show eight lines by 21 characters (64 by 128 pixels).

iOS and Android Devices

LoggerLink Mobile Apps are simple yet powerful tools that allow an iOS or Android device to communicate with our dataloggers via an IP device. LoggerLink for Android also supports Bluetooth communication for these same dataloggers using an RS-232-Bluetooth adapter. The apps support field maintenance tasks such as viewing and collecting data, setting the clock, and downloading programs..LoggerLink Mobile Apps are purchased through the Apple Store or Google Play.

While LoggerLink Apps does not support all of the functions of LoggerNet or RTDAQ, it can be a helpful tool to keep in your Campbell tool box.

Telemetry Peripherals



Key

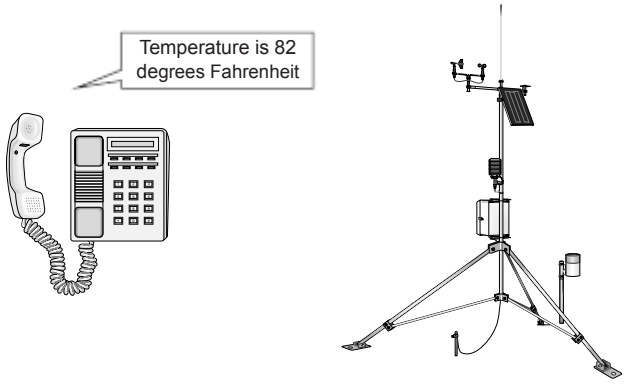
SC12 cable*	RF Connection Cable	Internet connection	Telephone Line
2-twisted pair	Wireless Telemetry	10baseT Ethernet Cable	Wi-Fi
RS-232 cable	Choice of Internet or phone system		

**Assumes connection to the datalogger's CS I/O port. Refer to the device's product brochure to determine the appropriate configuration for connecting to the datalogger's RS-232 port.*

Land-Line and Voice Synthesized Telephone Networks

The COM220 Phone Modem at the datalogger site transmits data over land lines. A Hayes-compatible modem at the calling end is required and surge protection at the datalogger site is strongly recommended.

The COM320 Voice-Synthesized Modem enables anyone to call a datalogger via phone and receive a verbal report of real-time site conditions.



You can use any phone to call a COM320-equipped site and receive a verbal report of site conditions.

Digital Cellular Telephone Networks

The RavenXTV is a CDMA modem configured for Verizon cellular networks, and the LS300G is a a cellular gateway for use on GSM/GPRS/EDGE/HSPA+ networks such as AT&T, Rogers, Bell, and Telus. These devices transmit the datalogger's data to a local cellular tower. The CDMA or GPRS/EDGE/HSPA+ network then routes the data to the base station computer via the Internet.

Internet and IP Networks

The following methods allow our dataloggers to communicate with a computer using TCP/IP.

- **NL240 module**—provides Wi-Fi connectivity to our dataloggers and peripheral devices over standard 802.11b/g/n networks. It also provides access to the datalogger's internal TCP/IP stack.
- **NL116 and NL121 modules**—support Ethernet communications via the peripheral port on a CR1000 or CR3000 datalogger. They also provide access to the datalogger's internal TCP/IP stack.
- **NL201 module**—provides access to the datalogger's internal TCP/IP stack, and is compatible with PakBus dataloggers.
- **CR6 and CR9000X's on-board 10baseT/100baseT port**—supports Ethernet communications without using an Ethernet interface.

Multidrop

The MD485 intelligent RS-485 interface permits a PC to address and communicate with one or more dataloggers over a single CABLE2TP two-twisted pair cable.

Radio Frequency (RF) Networks

Our RF networks transmit data over a radio frequency. Line-of-sight is required for all RF networks.

- **RF320-series UHF/VHF narrowband radios**—transmit data for up to 25 miles, line-of-sight. At the field station and repeater stations, the radio is attached to an RF500M modem. The computer base station should include a radio, PC, and an RF500M modem or RF500B base station. The RF320-series radios require an FCC license.
- **RF401A-series, RF432, and RF450 spread spectrum radios**—provide communications between a base station computer and several field stations over short distances. An individual FCC license is not required.

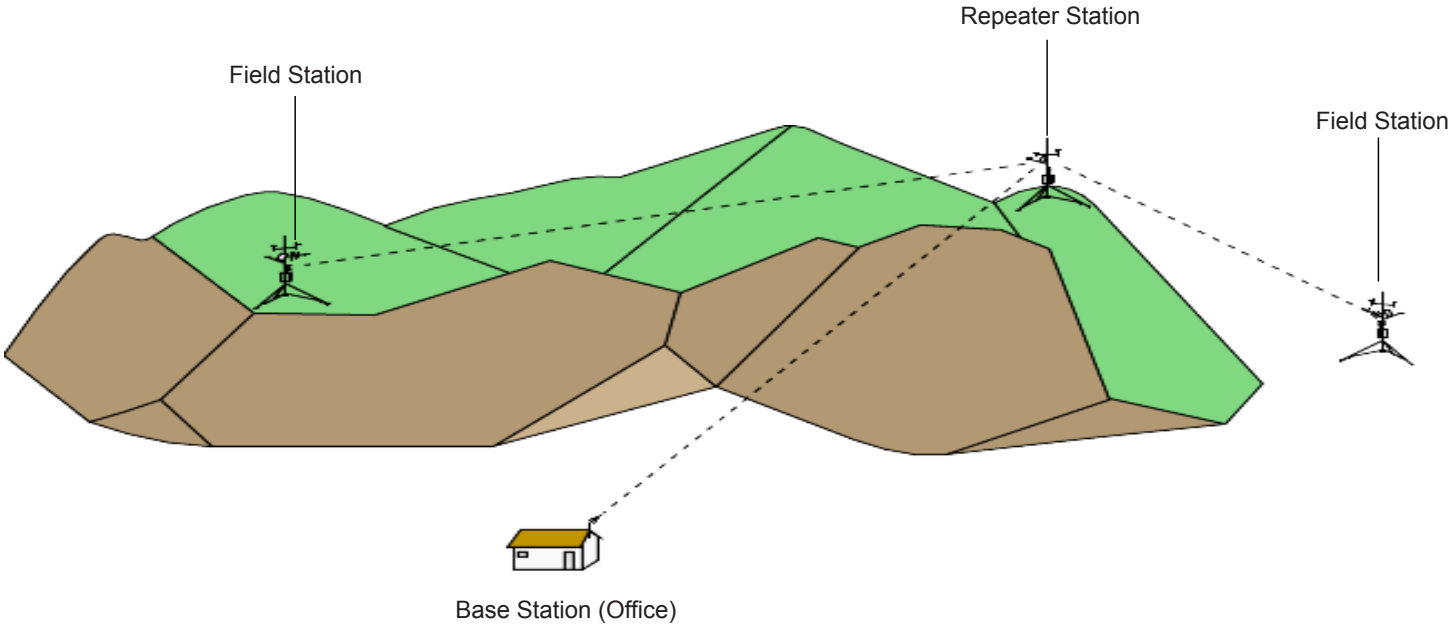
Satellite

Our satellite transmitters provide one-way communications from the datalogger site to a receiving station.

- **TX320**—uses the GOES system. This NESDIS-certified transmitter complies with the High Data Rate version 2 (CS-2) specifications.
- **ST-21 PTT**—uses the Argos system. Argos field sites are well suited for deployment in high latitudes.
- **Iridium 9522B**—uses the Iridium system. The Iridium system is ideal for stations at very high-angle latitudes, high-altitude applications, and mobile applications, such as buoys or ships.
- **Hughes9502**—uses Inmarsat Broadband Global Area Network (BGAN) to provide reliable end-to-end IP connectivity.

Short Haul

The SRM-5A Short Haul Modem supports communications between the datalogger and a computer via a four-wire unconditioned line (two twisted pairs).



All of our RF networks require line-of-sight transmission. The mountain in this drawing obstructs line-of-sight with the base station. Use of the repeater station allows the base station to receive data from the field stations.

Software Support

The base station computer needs to be running one of our software packages. Our PC200W software is available, at no charge, from our website; it supports direct communications only. PC400, RTDAQ, and LoggerNet software support our direct and telemetry options. LoggerNet also supports scheduled data collection and combining data retrieval methods (e.g., phone-to-radio).

Combining Options

You can increase the flexibility, convenience, and reliability of your application's data storage and retrieval by combining an on-site device with a telemetry device. For example, cellular phone with on-site back-up provided by a CompactFlash card combines an on-site and telemetry device. You can also combine two telemetry methods. Popular telemetry combinations are Ethernet-to-radio, multidrop-to-spread spectrum radio, phone-to-multidrop, Ethernet-to-multidrop, and phone-to-radio.

Telemetry Comparison Table

DEVICE	TRANSMISSION DISTANCE OR AREA	COMMUNICATION RATE OR THROUGHPUT	CURRENT DRAIN @ 12 Vdc	SERVICE REQUIREMENTS
NL116 or NL121 Ethernet Interface	Worldwide	115.2 kbps	58 mA typical; 3 mA Ethernet off	Ethernet access
NL201 Ethernet Interface	Worldwide	115.2 kbps	50 mA active; 2 mA forced standby	Ethernet access
NL240 Wi-Fi Interface	Worldwide	RS-232: 1200 to 115.2k bps CS I/O: 9600 to 460.8k bps	79.2 mA maximum; 1.3 mA sleep	Wi-Fi hotspot (access to standard 802.11b/g/n networks)
MD485 Multidrop Modem	4000 ft (can increase distance by using more MD485s or combining w/spread spectrum radios, Ethernet, or phone)	1200 bps, 9600 bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps	1.2 mA standby; 2 to 7 mA communicating	CABLE2TP two-twisted pair cable must be installed between networked dataloggers and base.
RF320-Series Narrowband VHF/UHF Radios with RF500M modem	Up to 25 miles between stations (line-of-sight); effective distance can be increased using repeaters	1200 bps, 9600 bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps	25 mA receive standby; <900 mA (transmit 2 W RF power) <1200 mA (transmit 5 W RF power)	FCC-assigned frequency and license. Line-of-sight required.
RF401A/RF411A Spread Spectrum Radios	Up to 16 km (10 miles) with Yagi antennas at ideal conditions; up to one mile with inexpensive omni-directional antennas (line-of-sight obstructions and interference affects transmission length)	up to 38.4 kbps	<0.5 mA stand-by; 15 mA receiving; < 80 mA transmitting	Shares frequency with other devices. Not allowed to cause harmful interference to licensed radios. Line-of-sight is required.
RF432 Spread Spectrum Radio	Up to 16 km (10 miles) with Yagi antennas at ideal conditions; up to one mile with inexpensive omni-directional antennas (line-of-sight obstructions and interference affects transmission length)	up to 38.4 kbps	<1 mA stand-by; 40 mA receiving (RF432); 78 mA transmitting	Shares frequency with other devices. Not allowed to cause harmful interference to licensed radios. Line-of-sight is required.
RF450 Spread Spectrum Radio	Up to 96 km (60 miles) assuming ideal conditions, line-of-sight, and appropriate antenna; realistic reliable distance is ~21 km (13 miles). Antenna type, line-of-sight obstructions, and interference affects transmission length)	115.2 kbps	<7 mA sleep mode; <22 mA idle; <76 mA receiving; <500 mA transmitting	Shares frequency with other devices. Not allowed to cause harmful interference to licensed radios. Line-of-sight is required.
SRM-5A Short Haul Modem	7.6 miles	Up to 9600 bps	2.2 mA quiescent; 10 to 15 mA active	Dedicated 2-twisted pair cable connects one field station with base.
COM220 Phone Modem	Limitless as long as phone lines are installed	9600 bps, 38.4 kbps, 57.6 kbps, or 115.2 kbps (in practice, data transmission through phone lines is generally constrained to 33.6 kbps)	12 µA quiescent; 30 mA active	If not available at the site, phone lines must be installed.
RavenXTV CDMA Cellular Modem	Dependent on antenna used and CDMA coverage	Up to 80 kbps	50 mA dormant; 120 mA receive/transmit	CDMA coverage at the datalogger site and account at Verizon.
LS300G Sierra Wireless 3G GSM Cellular Gateway	Dependent on antenna used and GSM/GPRS/EDGE coverage	Download: 14.4 Mbps Upload: 5.76 Mbps	224 mA typical 430 mA maximum	GSM/GPRS/EDGE coverage at the datalogger site and account at AT&T, Rogers, Bell, or Telus
TX320 High Data Rate (HDR) version 2 GOES Satellite Transceiver	Western Hemisphere	100 bps, 300 bps, 1200 bps	0.5 mA idle; 15 mA during GPS fix, 2.6 A transmitting	Formal permission to use the GOES system must be acquired from NESDIS. Non-U. S. government agencies and research organizations must have a sponsor from a U.S. government agency.
ST-21 Argos Satellite Transceiver	Worldwide	Latitude dependent. From 448 average bytes per day at the equator to 1792 average bytes per day at the poles.	1.12 mA quiescent, 375 mA transmitting	To use the Argos system, you must receive formal permission from Service Argos and pay a fee. The data must be used for environmental purposes.
IRIDIUM9522B Satellite Modem	Worldwide (including poles, oceans and airways)	19.2 kbps	Operating: 333 mA Standby: 125 mA	Needs a SIM card and must pick a service provider and pay a fee.
HUGHES9502 Inmarsat BGAN Satellite IP Terminal	Worldwide between +70° and -70° latitude	115.2 kbps	Transmit: < 1.7 A peak Off, GPIO sleep pin control < 0.3 mA	Needs a SIM card and must pick a service provider and pay a fee.

Telemetry Compatibility Table

DEVICE	CR200X-SERIES	CR800/ CR850	CR1000	CR6	CR3000	CR9000X
INTERNET AND IP NETWORKS						
NL116 Ethernet/CF Interface			see note 2		see note 2	
NL121 Interface			see note 2		see note 2	
NL201 Interface	see note 3	✓	✓	see note 4	✓	see note 4
NL240 Wi-Fi Interface	see note 3	✓	✓		✓	see note 5
MULTIDROP						
MD485 Modem	✓	✓	✓	✓	✓	
RF NETWORKS						
RF320-Series Narrowband UHF/VHF Radios	see note 6	✓	✓	✓	✓	
RF500M/RF500B Narrowband Modem/Base Station	✓	✓	✓	✓	✓	
RF401A/RF411A Spread Spectrum Radios	✓	✓	✓	✓	✓	see note 7
RF432 Spread Spectrum Radio	✓	✓	✓	✓	✓	see note 7
RF450 Spread Spectrum Radio	✓	✓	✓	✓	✓	see note 7
SATELLITE						
TX320 HDR version 2 (CS-2) GOES Transmitter	CR295X only	✓	✓	✓	✓	
ST-21 Argos Transceiver		✓	✓	✓	✓	
Iridium9522B Satellite Modem and Interface Kit	✓	✓	✓	✓	✓	
HUGHES9502 Inmarsat BGAN Satellite IP Terminal	✓	✓	✓	✓	✓	✓
SHORT HAUL						
SRM-5A Rad Modem		✓	✓	✓	✓	see note 7
TELEPHONE NETWORKS						
COM220 Phone Modem		✓	✓	✓	✓	see note 7
COM320 Voice Synthesizer Phone Modem		✓	✓	✓	✓	
RavenXTV Digital Cellular Modem	✓	✓	✓	✓	✓	see note 7
LS300G 3G GSM Cellular Gateway	✓	✓	✓	✓	✓	see note 7

Notes:
1. To determine compatibility with devices not offered by Campbell Scientific or devices not listed on this chart, refer to the device's product brochure or manual, or contact a Campbell Scientific applications engineer.
2 To be compatible with the NL116 and NL121, the CR1000 and CR3000 must use operating system version 28 or greater.
3 The CR200X-series dataloggers are not compatible with the bridge mode functionality of the NL201 and NL240 interfaces.
4. Although compatible, the CR6 and CR9000X have an on-board Ethernet connector and therefore an Ethernet interface is not required.
5. The CR9000X are only compatible with the serial server functionality of the NL201 and NL240 interfaces.
6. The CR200X-series dataloggers are only compatible with the RF320-series radios when the RF500M modem is used.
7. Although compatible, these devices do not support the CR9000X's maximum communication rate. Therefore these devices may not be practical for many CR9000X applications.

On-Site Compatibility Table

DEVICE	CR200X-SERIES	CR800/ CR850	CR1000	CR6	CR3000	CR9000X
DIRECT CONNECT						
RS-232 Cable (w/o an interface)	✓	✓	✓	✓	✓	✓
USB Cable (w/o an interface)				✓		
SC32B Interface		✓	✓	✓	✓	✓
SC-USB Interface		✓	✓	✓	✓	✓
SC115 USB Interface		✓	✓	✓	✓	
SC929 CS I/O Cable		✓	✓	✓	✓	✓
FIELD DISPLAYS						
CR1000KD Keyboard Display		✓	✓	✓		
CD100 Mountable Display with Keypad		✓	✓	✓		
iOS DEVICES AND ANDROID DEVICE						
iOS Devices (see note 2)		✓	✓		✓	✓
Android Devices (see note 3)		✓	✓		✓	✓
EXTERNAL DATA STORAGE DEVICES						
SC115 Memory Drive		✓	✓	✓	✓	
MicroSD Card				✓		
Type I, II, or III PC Cards						✓
CF1 Adapter with CF Card						✓
CFM100 Module with CF Card			✓		✓	
NL116 Module with CF Card (see note 4)			✓		✓	

Notes:

1. To determine compatibility with devices not offered by Campbell Scientific or devices not listed on this chart, refer to the device's product literature or manual, or contact a Campbell Scientific applications engineer.
2. Using an iOS device requires purchasing the LoggerLink mobile app through the Apple Store.
3. Using an Android device requires purchasing the LoggerLink mobile app through Google Play.
4. To be compatible with the NL116, the CR1000 and CR3000 must use operating system version 28 or greater.

© 1992, 2015
Campbell Scientific, Inc.
April 29, 2015